



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029**

June 24, 2013

Ms. Kelly Jean Heffner
Deputy Secretary for Water Management
Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 2063
Harrisburg, Pennsylvania 17105

Dear Ms. Heffner:

The U.S. Environmental Protection Agency (EPA) is pleased to approve the sediment Total Maximum Daily Load (TMDL) for the Delaware Run watershed. The TMDL was established to address impairments of water quality, caused by siltation, as identified on Pennsylvania's 2010 Section 303(d) List. The Pennsylvania Department of Environmental Protection submitted the TMDL Report, *Delaware Run Watershed TMDL, Northumberland and Lycoming Counties, Pennsylvania*, to EPA for review and approval on September 5, 2012. The TMDL was established and submitted in accordance with Sections 303(d)(1)(c) and 303(d)(2) of the Clean Water Act. A rationale of our approval is enclosed.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) be designed to attain and maintain the applicable water quality standards; (2) include a total allowable loading and, as appropriate, wasteload allocations for point sources and load allocations for nonpoint sources; (3) consider the impacts of background pollutant contributions; (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated); (5) consider seasonal variations; (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality); and (7) be subject to public participation. The sediment TMDL for the Delaware Run watershed satisfies each of these requirements. In addition, the TMDL considers reasonable assurance that the TMDL allocations assigned to nonpoint sources can be reasonably met.

As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL wasteload allocations pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated September 29, 1998.



If you have any questions please call me, or contact Ms. Jennifer Sincock, Pennsylvania TMDL Coordinator, at 215-814-5766.

Sincerely,

/S/

Jon M. Capacasa, Director
Water Protection Division

Enclosure

cc: Bill Brown, PADEP





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1650 Arch Street
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Decision Rationale
Total Maximum Daily Load of Sediment
Delaware Run Watershed
Northumberland and Lycoming Counties, Pennsylvania

/S/

Jon M. Capacasa, Director
Water Protection Division

Date: June 24, 2013



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Decision Rationale
Total Maximum Daily Load of Sediment
Delaware Run Watershed
Northumberland and Lycoming Counties, Pennsylvania

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those waterbodies identified as impaired by a state where technology based and other controls will not provide for the attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a Margin of Safety (MOS), that can be discharged to a water quality limited waterbody.

This document sets forth the U.S. Environmental Protection Agency's (EPA) rationale for approving the TMDL for sediment in the Delaware Run watershed. The TMDL was established to address impairments of water quality, caused by siltation, as identified on Pennsylvania's 2010 Section 303(d) List for water-quality limited segments. The Pennsylvania Department of Environmental Protection (PADEP) submitted the TMDL Report, *Delaware Run Watershed TMDL, Northumberland and Lycoming Counties, Pennsylvania*, to the EPA for final review and approval on September 5, 2012. The TMDL report addresses sixteen impaired stream segments in the Delaware Run watershed.

EPA's rationale is based on the determination that the TMDL meets the following seven regulatory conditions pursuant to 40 CFR Part 130.

1. The TMDL is designed to implement applicable water quality standards.
2. The TMDL includes a total allowable load as well as individual wasteload allocations (WLAs) and load allocations (LAs).
3. The TMDL considers the impact of background pollutant contributions.
4. The TMDL considers critical environmental conditions.
5. The TMDL considers seasonal environmental variations.
6. The TMDL includes an MOS.
7. The TMDL has been subject to public participation.

In addition, the TMDL considers reasonable assurance that the TMDL allocations assigned to nonpoint sources can be reasonably met.

II. Summary

Table 1 presents the Pennsylvania 2010 Section 303(d) listing information for the Delaware Run watershed.¹

¹ 2010 Pennsylvania Integrated Water Quality Monitoring and Assessment Report. Pennsylvania Department of Environmental Protection: Harrisburg, Pennsylvania.



**Table 1. Pennsylvania's 2010 Section 303(d) List of Impaired Stream Segments
in the Delaware Run Watershed**

Segment ID	Year Listed	Stream Name	HUC	Source	Cause	Miles
10453	2002	Delaware Run	02050206	Agriculture	Siltation	8.35
10453	2002	Delaware Run (UNT 66917197)	02050206	Agriculture	Siltation	0.39
10453	2002	Delaware Run (UNT 66917249)	02050206	Agriculture	Siltation	0.33
10453	2002	Delaware Run (UNT 66917333)	02050206	Agriculture	Siltation	0.96
10453	2002	Delaware Run (UNT 66917373)	02050206	Agriculture	Siltation	0.85
10453	2002	Delaware Run (UNT 66917389)	02050206	Agriculture	Siltation	0.36
10453	2002	Delaware Run (UNT 66917441)	02050206	Agriculture	Siltation	1.30
10453	2002	Delaware Run (UNT 66917705)	02050206	Agriculture	Siltation	0.75
10453	2002	Delaware Run (UNT 66917277)	02050206	Agriculture	Siltation	0.46
10523	2002	Delaware Run (UNT 66917473)	02050206	Agriculture Grazing Related	Siltation	0.54
10453	2002	Delaware Run (UNT 66917503)	02050206	Agriculture	Siltation	0.51
10523	2002	Delaware Run (UNT 66917503)	02050206	Agriculture	Siltation	0.62
10453	2002	Delaware Run (UNT 66917551)	02050206	Agriculture	Siltation	1.21
10453	2002	Delaware Run (UNT 66917585)	02050206	Agriculture	Siltation	1.51
10453	2002	Delaware Run (UNT 66917659)	02050206	Agriculture	Siltation	0.27
10453	2002	Delaware Run (UNT 66917709)	02050206	Agriculture	Siltation	0.19

Pennsylvania's 2010 Section 303(d) List has identified 18.61 miles within the Delaware Run watershed as impaired by siltation (sediment). Attachment A of the TMDL Report, *Maps of Impaired and Reference Watersheds*, presents a geographical depiction of the impaired stream segments that will need to be addressed through the development of a TMDL in the Delaware Run watershed.

III. Background

The Delaware Run watershed is a part of the State Water Plan (SWP) 10D and is located within the Hydrologic Unit Code (HUC) 02050206 (Lower West Branch Susquehanna). The entire drainage area of the Delaware Run watershed is located in Northumberland and Lycoming Counties. Delaware Run, including all of its headwater tributaries, consists of 18.61 stream miles and is approximately 11.7 square miles in size. The dominate land use in the watershed is agriculture, which constitutes 54 percent



of the total land use area. Other land use types in the Delaware Run watershed include forest (37%) and developed (9%) land uses.

The Delaware Run watershed was first identified as impaired in 2002 based on data collected through the Statewide Surface Waters Assessment Protocol (SSWAP). The SSWAP is a modification of EPA's 1989 Rapid Bioassessment Protocol II and provides for a more consistent approach for assessing impairments in Pennsylvania's rivers and streams than previously used methods. Through the use of the SSWAP in the Delaware Run watershed, an impairment was documented based on biological surveys, habitat surveys, and water quality sampling. The cause of the impairment was determined to be from excessive sediment loading emanating from agricultural land use practices, as indicated in Table 1.

A TMDL was developed for sediment in order to address the water quality impairments identified by the state. A numeric TMDL endpoint was established for the watershed through the use of computer-based modeling to ensure that the appropriate water quality standards are met during the implementation of the TMDL, as required by Pennsylvania's water quality standards at Pennsylvania Code Title 25, Chapter 96.3c.² Table 2 presents the sediment TMDL developed for the Delaware Run watershed, on a daily load basis. In order to meet the TMDL endpoint established for the watershed, sediment loadings will need to be limited to a total of 9,387.73 pounds per day (lbs/day).

**Table 2. Delaware Run Watershed
Sediment TMDL (lbs/day)**

TMDL	WLA	LA	MOS
9,387.73	93.88	8,355.08	938.77

Computational Procedures

The ArcView Generalized Watershed Loading Function (AVGWLF)³ model was used to establish the existing loading conditions for the Delaware Run watershed. The AVGWLF model provides the ability to simulate runoff, sediment, and nutrient (N and P) loadings from a watershed given variable-size source areas (e.g., agricultural, forested and developed land). When establishing the existing conditions for a watershed, seasonal variations in hydrology, climatic conditions, and watershed activities are explicitly accounted for. The primary source of data for the AVGWLF model is geographical information system (GIS) formatted databases and shapefiles. This information is used in the model to automatically derive the required values for model parameters. Table 3 presents the existing loading conditions produced for sediment in the Delaware Run watershed.

**Table 3. Existing Loading Conditions in the
Delaware Run Watershed (lbs/day)**

Pollutant	Existing Loading Conditions
Sediment	15,937.48

² Pennsylvania Department of Environmental Protection. *Pennsylvania Code*. Chapter 93 Water Quality Standards. <http://www.pacode.com/secure/data/025/chapter93/chapter93toc/html>

³ ArcView Generalized Watershed Loading Function model, the Environmental Resources Research Institute of Pennsylvania State University's ArcView based version of the GWLF model developed by Cornell University.



A reference watershed approach was used to establish the load reductions required for the Delaware Run watershed. A reference watershed approach is based on selecting a non-impaired watershed that shares similar land use, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference watershed are assumed to be the conditions needed for the impaired watershed to attain standards. Therefore, the TMDL intends to replicate the loadings of the reference watershed in the impaired watershed to allow it to attain water quality standards. The equation used to obtain the TMDL value through the reference watershed approach in the Delaware Run watershed is expressed below:

$$\begin{array}{ccccc} \textit{Area of Impaired Watershed} & & \textit{Unit Area Loading Rate of the} & & \textit{TMDL value for the Impaired} \\ \textit{(ac)} & x & \textit{Reference Watershed} & = & \textit{Watershed} \\ & & \textit{(lb/ac/day)} & & \textit{(lb/day)} \end{array}$$

IV. Discussion of Regulatory Conditions

EPA finds that Pennsylvania has provided sufficient information to meet all seven of the basic requirements for establishing a TMDL for sediment in the Delaware Run watershed. Additionally, Pennsylvania provided reasonable assurance that the TMDL can be met. EPA is, therefore, approving the TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to meet the applicable water quality standards.

Water quality standards are state regulations that define the water quality goals of a waterbody. Water quality standards are comprised of three components: (1) designated uses, (2) criteria necessary to protect those uses, and (3) antidegradation provisions that prevent the degradation of water quality. There are no "high quality," or Tier II, stream segments in the impaired portion of the Delaware Run watershed that require the implementation of Pennsylvania's antidegradation policy. The designated use of the Delaware Run watershed is Warm Water Fishes and Migratory Fishes, as referenced in Pennsylvania Title 25 §93.9.

Pennsylvania does not currently have specific numeric criteria for sediment. Therefore, to establish endpoints such that the designated uses of the Delaware Run watershed are attained and maintained, Pennsylvania utilizes its narrative water quality criteria, which states that:

Water may not contain substances attributable to point or nonpoint source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life.

To establish TMDL endpoints for sediment that are protective of the Delaware Run's designated uses, a reference watershed approach was used. The objective of a reference watershed approach is to reduce the loading rate of a pollutant in an impaired stream segment to a level equivalent to the loading rate in a non-impaired reference stream segment. This load reduction will result in conditions favorable to the return of a healthy biological community in the impaired stream segment.

The selection of a reference watershed for an impaired watershed must follow specific guidelines to ensure that a suitable match is identified. In general, three factors are considered when selecting a suitable reference watershed: (1) attainment of water quality standards using the SSWAP; (2) close



resemblance to the impaired watershed in physical properties such as land cover/land use, physiographic province, and geology; and (3) similarity in size (within 20-30% of the impaired watershed area). Both the impaired watershed and the reference watershed should be matched to the best extent possible; however, most variations can be adjusted in the AVGWLF model, if necessary.

The Mugser Run watershed was selected as the reference watershed for the Delaware Run watershed after field surveys and evaluations of background data verified that it was best suited for the reference watershed approach. The suitability of the Mugser Run watershed was further confirmed through discussions with both PADEP staff and stakeholders familiar with the watershed. Mugser Run is located in State Water Plan subbasin 5E and is a tributary to the Roaring Creek. The tributary is currently designated as a High Quality Cold Water Fishery (25 PA. Code Chapter 93). Based on Pennsylvania's 2010 Integrated List, the reference watershed is currently attaining its designated uses. Table 4 presents the land use comparison between the Delaware Run watershed and the reference watershed.

Table 4. Land use Comparison between the Delaware Run Watershed and the Reference Watershed

Pollutant Source	Delaware Run Watershed (acres)	Mugser Run Watershed (acres)
Hay/Pasture	1,502.4	1,781.6
Cropland	2,510.6	1,685.3
Forest	2,770.0	3,805.4
Wetland	0.0	9.9
Unpaved Road	14.8	12.4
Transitional	29.7	19.8
Low Intensity Development	664.7	276.8
High Intensity Development	0.0	2.5
Total	7,492.2	7,593.7

EPA finds that the TMDL will attain and maintain the applicable water quality standards through the reference watershed approach. Refer to Table 2 for a summary of the allowable loads for the Delaware Run watershed.

2) *The TMDL includes a total allowable load as well as individual wasteload allocations and load allocations.*

Total Allowable Loads

EPA regulations at 40 CFR §130.2(i) state that *the total allowable load shall be the sum of individual WLAs for point sources, LAs for nonpoint sources, and natural background concentrations.* The sediment TMDL developed for the Delaware Run watershed is consistent with 40 CFR §130.2(i) because the total loads provided by PADEP equal the sum of the individual WLAs for the point sources and the land based LAs for nonpoint sources.



Wasteload Allocations

The WLA portion of the TMDL is the total amount of the pollutant loading that is assigned to point sources. In the Delaware Run watershed, there are no point sources permitted to discharge sediment into the watershed. To account for the future growth of point sources in the watershed, a bulk reserve was included in the WLA and was calculated as one percent of the TMDL value. The WLA for the Delaware Run watershed is presented in Table 2.

Load Allocations

The LA is the actual portion of the TMDL that is assigned to nonpoint sources. In the Delaware Run watershed, the LA was computed by subtracting the WLA and the MOS from the TMDL value. The calculation used to obtain the LA value for sediment in the Delaware Run watershed is expressed below:

$$\text{Sediment LA (lbs/day)} = 9,387.73 \text{ (TMDL)} - 93.88 \text{ (WLA)} - 938.77 \text{ (MOS)} = 8,355.08$$

The Equal Marginal Percent Reduction (EMPR) allocation method was used to distribute the LA to the nonpoint sources of sediment in the watershed. The EMPR procedures were performed using Microsoft Excel and are described in Attachment F of the TMDL Report. Table 5 presents the LAs developed for the nonpoint sources of sediment in the Delaware Run watershed.

Table 5. Load Allocations for the Delaware Run Watershed

Pollutant Source	Loading Rate (lbs/day)
Hay/Pasture	382.80
Cropland	6,058.22
Forest	103.89
Developed	117.48
Stream Banks	1,692.69
Total	8,355.08

3) The TMDL considers the impacts of background pollution.

The sediment TMDL for the Delaware Run watershed considers the impact of background pollutants by considering loadings from background sources like forests, and calibrating the AVGWLF model to observed conditions.

4) The TMDL considers critical environmental conditions.

According to EPA's regulation 40 CFR §130.7(c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of an impaired watershed will be protected during the times when it is most vulnerable.



The AVGWLF model, which was used to develop the sediment TMDL for the Delaware Run watershed, is a continuous simulation model that uses daily time steps for weather data and water balance calculations. The model, therefore, incorporated the variable inputs needed to represent critical conditions during low flows – generally associated with point source loads, and critical conditions during high flows – generally associated with nonpoint source loads.

5) *The TMDL considers seasonal environmental variations.*

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods.

The AVGWLF model considers seasonal variation in the Delaware Run watershed through a number of mechanisms: Daily time steps were used for weather data and water balance calculations. In addition, the model also allowed for monthly-variable parameter inputs such as, hours of daylight in each month, the growing season, and the months of the year when manure is applied to the land. The combination of these actions by the model accounts for seasonal variability.

6) *The TMDLs include a Margin of Safety.*

This requirement is intended to add a level of safety to the modeling process. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions; or explicit, taken as a percentage of the WLA, LA, or TMDL.

An explicit MOS of ten percent was used for the Delaware Run watershed sediment TMDL. The MOS was taken as a percentage of the TMDL to account for any uncertainties in the methodology used to determine the loadings.

7) *The TMDL has been subject to public participation.*

A notice of the availability for comments on the Delaware Run watershed TMDL was published in the *Pennsylvania Bulletin* on April 30, 2011, and *The Daily Item* and *Standard Journal* on April 25, 2011. A public meeting was held on May 2, 2011 at the Delaware Township building. The public participation process was provided for the submittal of comments. Pennsylvania did not receive any written comments during the public participation period for the TMDLs.

V. Discussion of Reasonable Assurance

Once the sediment TMDL for the Delaware Run watershed has been approved by EPA, measures must be taken to reduce pollution levels from nonpoint sources. PADEP intends on reducing the nonpoint sources of sediment through the use of Best Management Practices (BMPs) in the watershed. The BMPs that would be helpful in lowering the amount of sediment in the Delaware Run watershed include the following: establishment of cover crops, strip cropping, residue management, no till, crop rotation, contour farming, terracing, stabilizing heavy use areas, manure storage, rotational grazing, livestock exclusion fencing, and forested buffers.



Further ground truthing should be performed in order to assess both the extent of existing BMPs, and to determine the most cost effective and environmentally protective combination of BMPs required for meeting the sediment reductions in the Delaware Run watershed TMDL. A combined effort involving key personnel from the regional DEP office, the County Conservation District, Susquehanna River Basin Commission, and other state and local agencies would be most effective in accomplishing any ground truthing exercises.

EPA recognizes that reasonable assurance is also provided through Pennsylvania's Watershed Implementation Plans (WIPs) designed to meet target loads consistent with the Chesapeake Bay TMDL. The Chesapeake Bay TMDL, established by EPA in 2010, requires reductions of nitrogen, phosphorus and sediment loads throughout the Bay watershed to meet water quality standards that protect the designated uses in the Bay and its tidal tributaries. Pennsylvania's Phase I and Phase II WIPs together with the State's schedule of two-year milestones provide implementation strategies and a time line for achieving nitrogen, phosphorus, and sediment reductions across the State to meet Chesapeake Bay interim target loads by 2017, equivalent to 60% of the final target goals set for 2025 to fully implement the Chesapeake Bay TMDL in Pennsylvania. A Phase III Plan will be developed in 2017 to address the additional reductions needed from 2018 through 2025 to meet the final targets.

The sediment reductions for the Bay TMDL are independent of those needed to implement any TMDLs developed to address sediment-related impairments in Pennsylvania's non-tidal waterbodies (including Delaware Run watershed), although their reduction goals and strategies do overlap. For example, the implementation planning framework, developed by the Bay watershed jurisdictions in partnership with EPA, provides a staged approach to achieving Bay TMDL reduction goals that are also applicable to implementation of sediment TMDLs in local non-tidal watersheds. In short, sediment reductions required to meet the Chesapeake Bay TMDL will also support the restoration and protection of local water quality.

The following websites provide further information regarding Pennsylvania's efforts to implement the Chesapeake Bay TMDL.

PADEP Chesapeake Bay Program website:

http://www.portal.state.pa.us/portal/server.pt/community/chesapeake_bay_program/10513

Pennsylvania's Phase I WIP:

<http://files.dep.state.pa.us/Water/Chesapeake%20Bay%20Program/ChesapeakePortalFiles/WIPs/REVISED%20FINAL%20Chesapeake%20Bay%20WIP%20-%20sent%20to%20EPA%2012-23-10.pdf>

Pennsylvania's Phase II WIP:

[http://files.dep.state.pa.us/Water/Chesapeake%20Bay%20Program/ChesapeakePortalFiles/4-2-2012/Clean%20FINAL%20Phase%202%20WIP%203-30-2012%20\(2\).pdf](http://files.dep.state.pa.us/Water/Chesapeake%20Bay%20Program/ChesapeakePortalFiles/4-2-2012/Clean%20FINAL%20Phase%202%20WIP%203-30-2012%20(2).pdf)

Pennsylvania's Phase II WIP Wastewater Supplement:

http://files.dep.state.pa.us/Water/Wastewater%20Management/EDMRPortalFiles/Phase_2_WIP_Supplement.pdf

Pennsylvania's Milestones for 2011-2013:

<http://files.dep.state.pa.us/Water/Chesapeake%20Bay%20Program/ChesapeakePortalFiles/7-9-2012/PA%20FINAL%202012-2013%20Milestones.pdf>

